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Sugizaki

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(54) **SHEET PROCESSING APPARATUS AND COLOR ERASING APPARATUS**

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B41J 2/325	(2006.01)
B41J 2/32	(2006.01)
B65H 5/06	(2006.01)

(52) **U.S. Cl.**

CPC ... ***B65H 5/26*** (2013.01); ***B41J 2/32*** (2013.01); ***B65H 5/062*** (2013.01); *B41J 2202/37* (2013.01); *B65H 2402/441* (2013.01); *B65H 2402/63* (2013.01); *B65H 2402/64* (2013.01); *B65H 2404/6111* (2013.01)

(58) **Field of Classification Search**

CPC B41J 11/0045; B41J 2/00; B41J 2/325; B65H 5/26
USPC 347/171, 179
See application file for complete search history.

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(57) **ABSTRACT**

a sheet processing apparatus comprises a main body side guiding module, a first movable module, a second movable module and a connection module. The main body side guiding module guides a sheet. The first movable module moves to a second position to open the conveyance path through motion from a first position opposite to the main body side guiding module, towards a first direction. The second movable module holds a detachable processing module for carrying out a given processing on the sheet, and moves integrally with the first movable module from the first position to the second position. The connection module connects the second movable module with the first movable module in such a manner that the second movable module can move to a third position to expose the processing module through motion from the second position in a second direction opposite to the first direction.

5 Claims, 8 Drawing Sheets

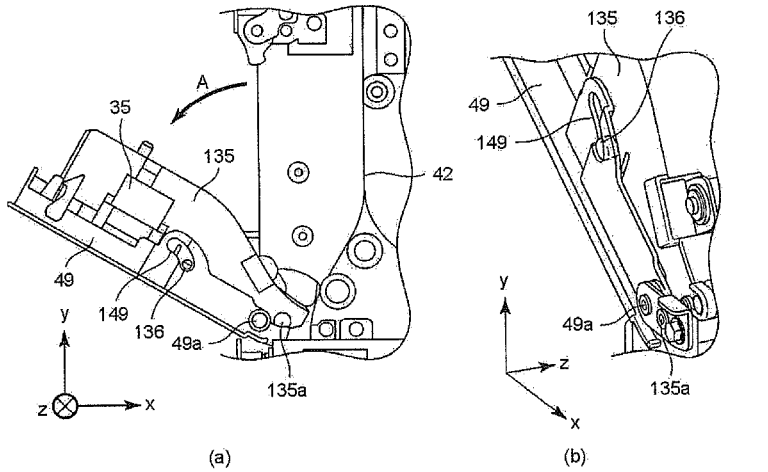
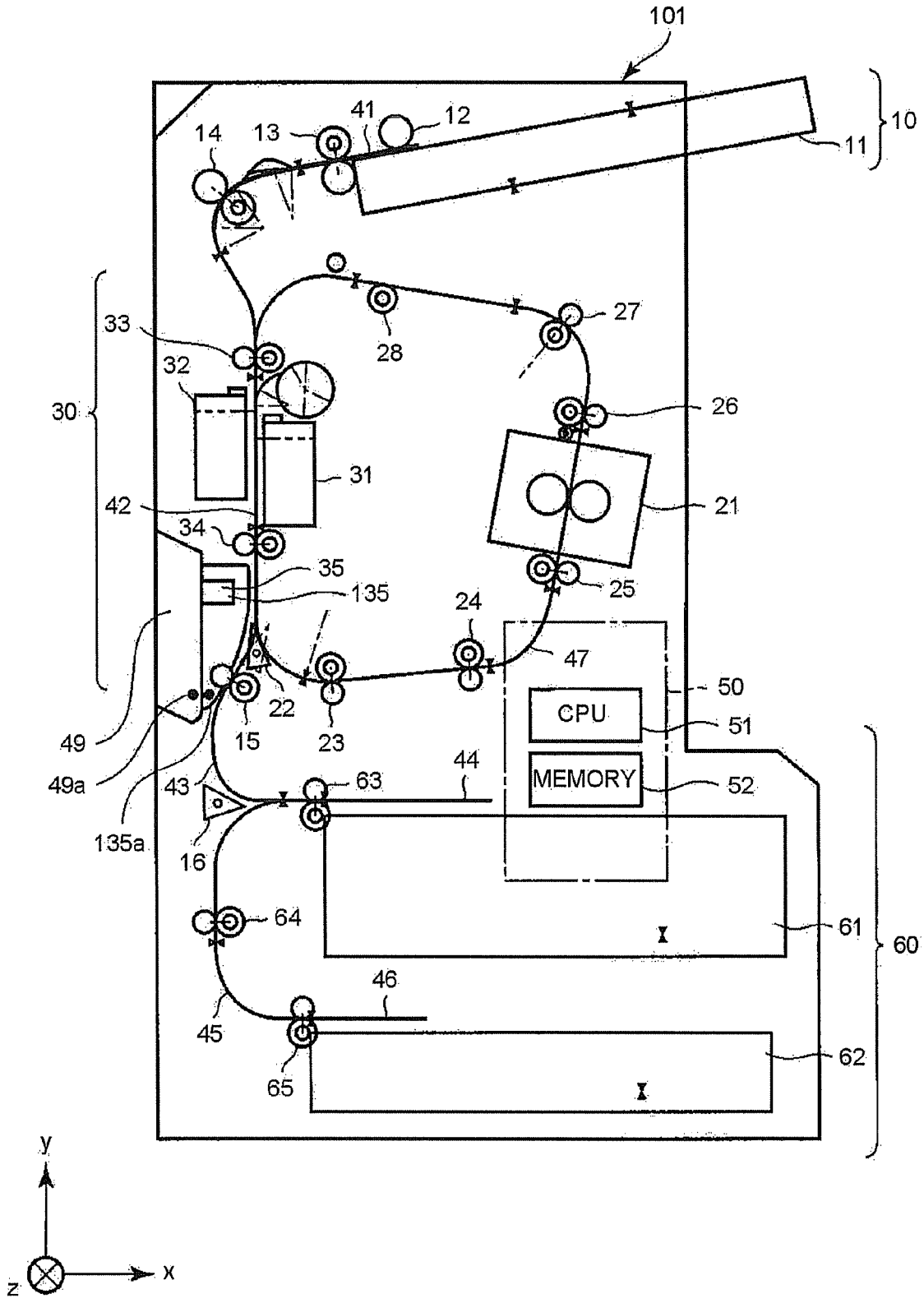


FIG.1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50
CPU
51
MEMORY
52
49
49a
135a
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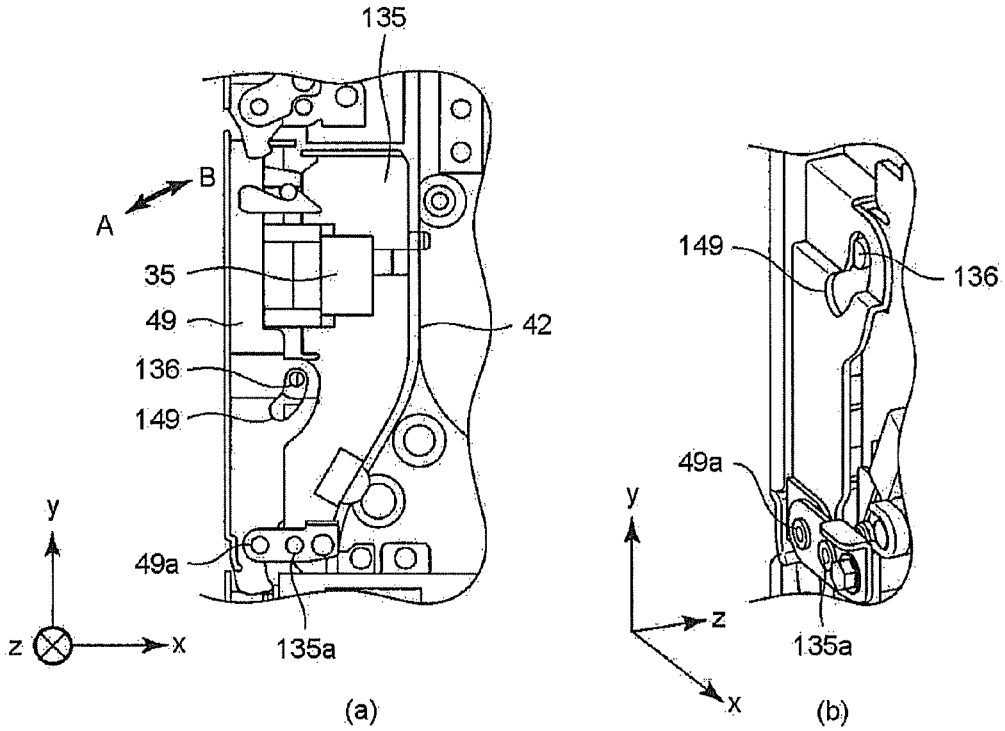
16
64
61
60
46
45
65
62
y
x
z

FIG.2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49
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(a)
149
136
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x
(b)

FIG.3

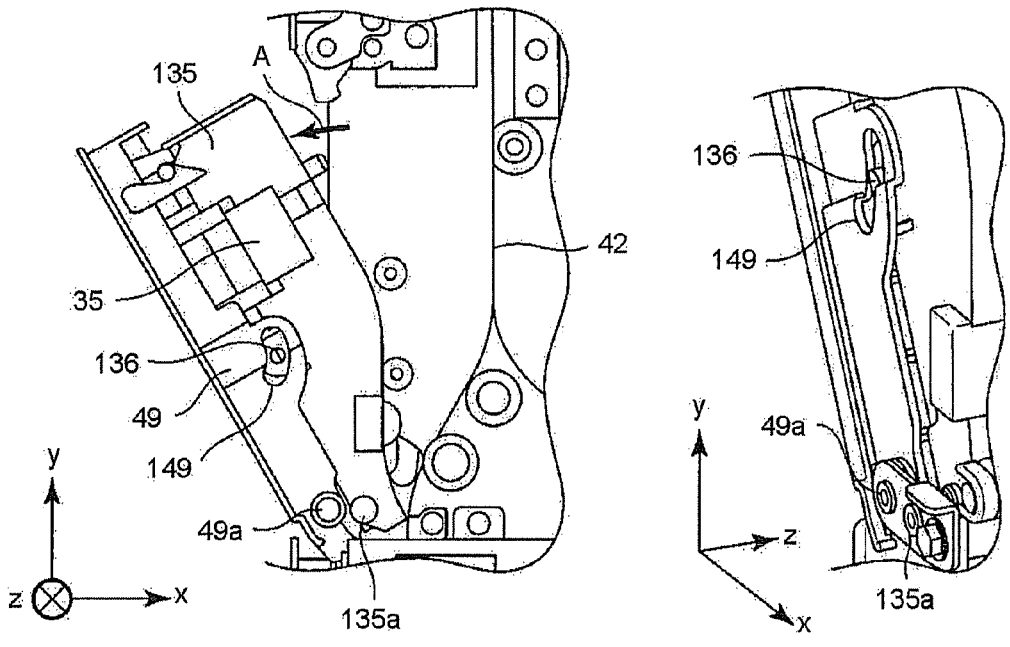
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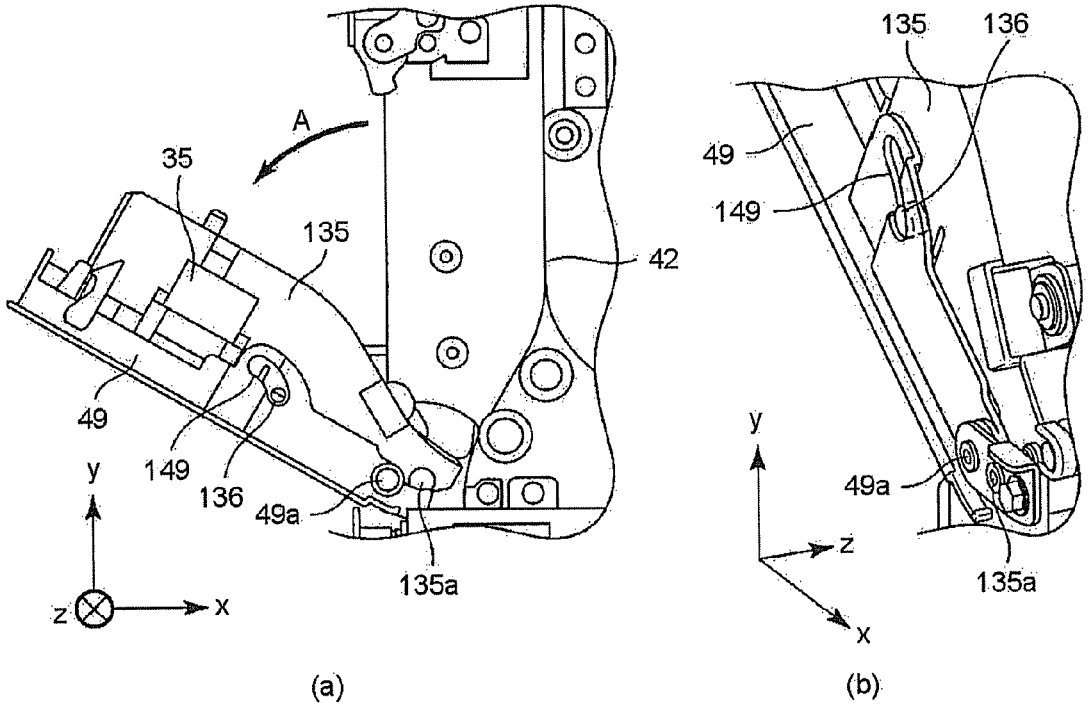
FIG.4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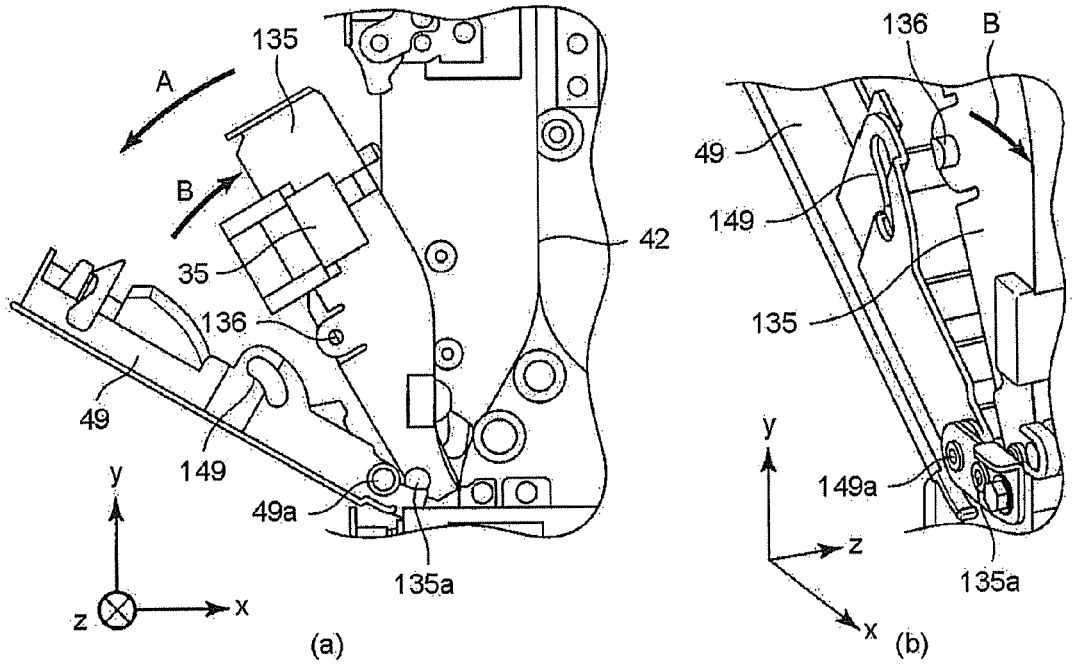
(b)

FIG.5


135
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B
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y
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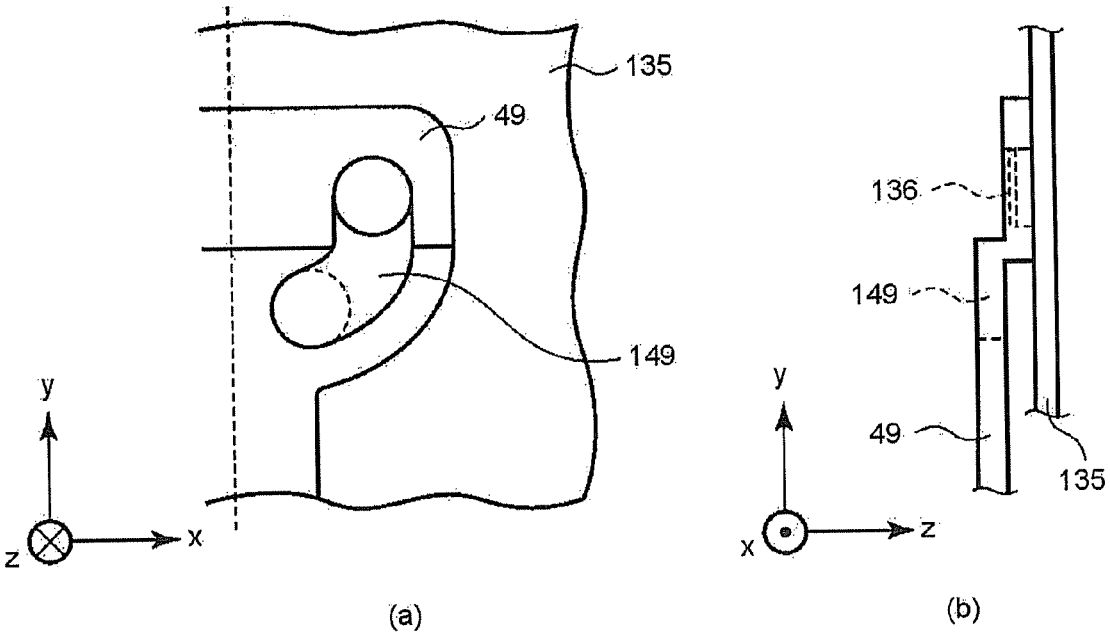
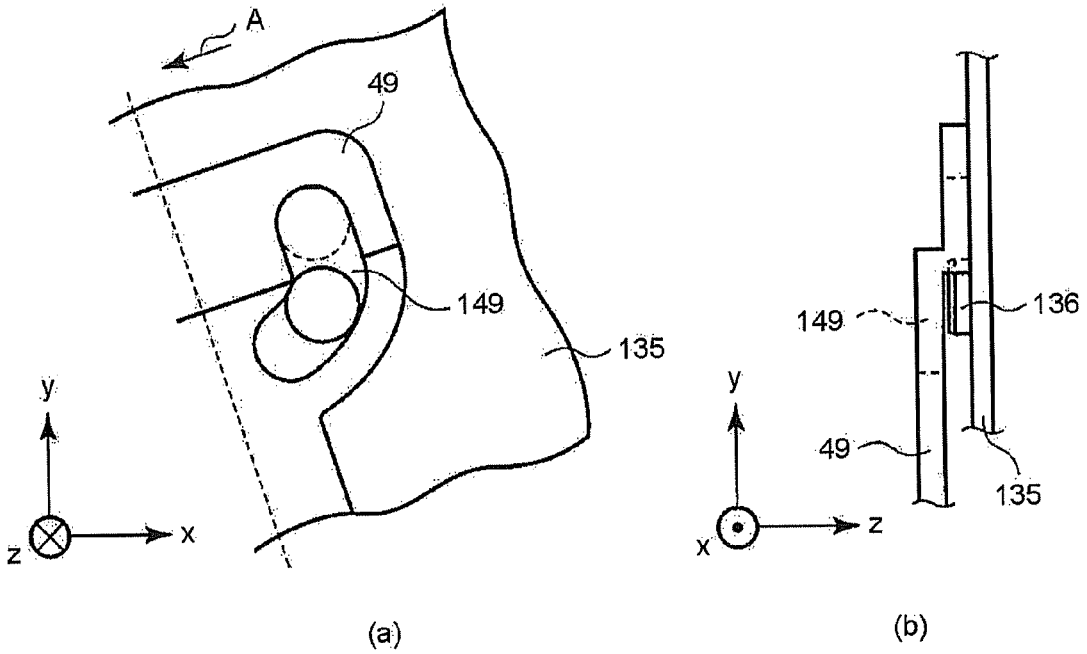
x
(b)

FIG.6A



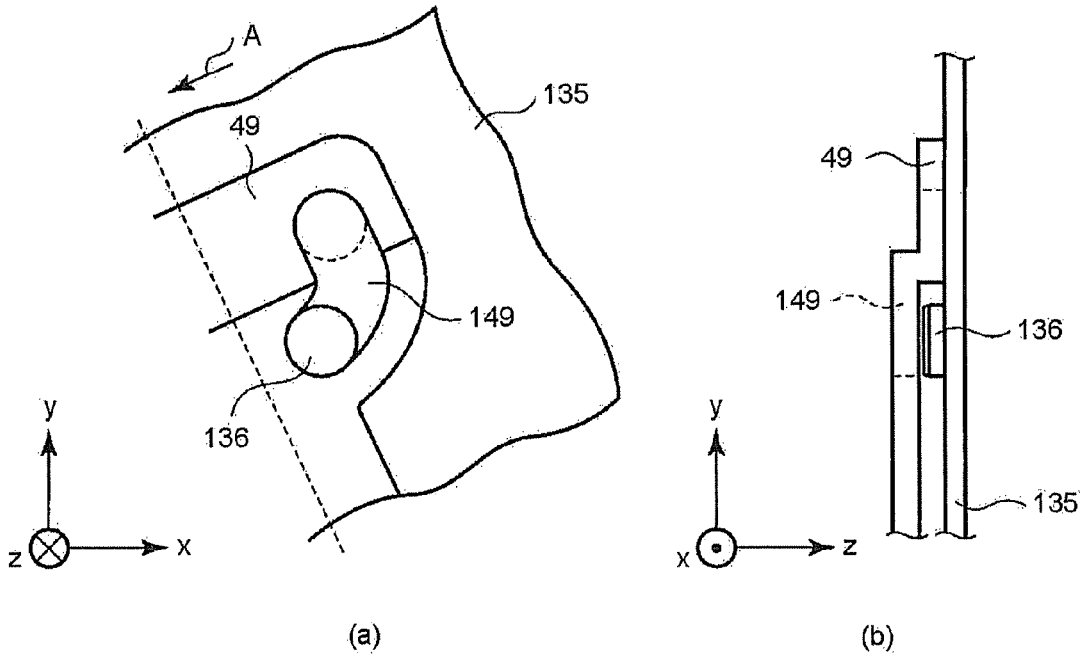
(a) (b)

FIG.6B



(a) (b)

FIG.6C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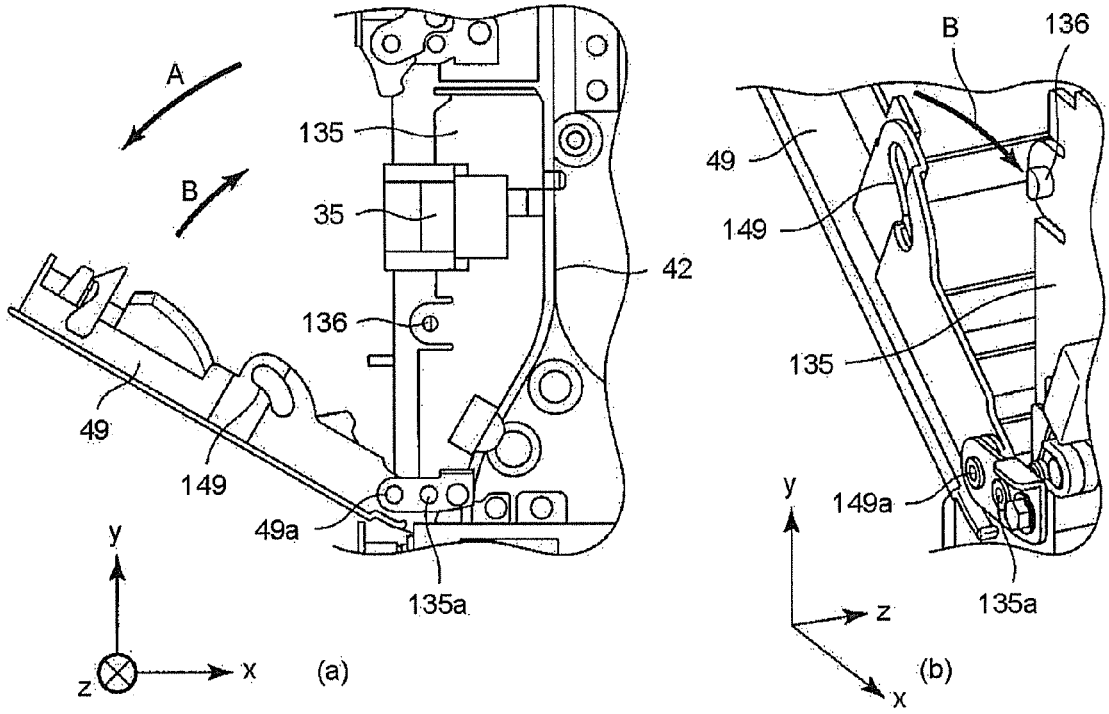
x
z
(b)

FIG.7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149
49a
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x
(a)
B
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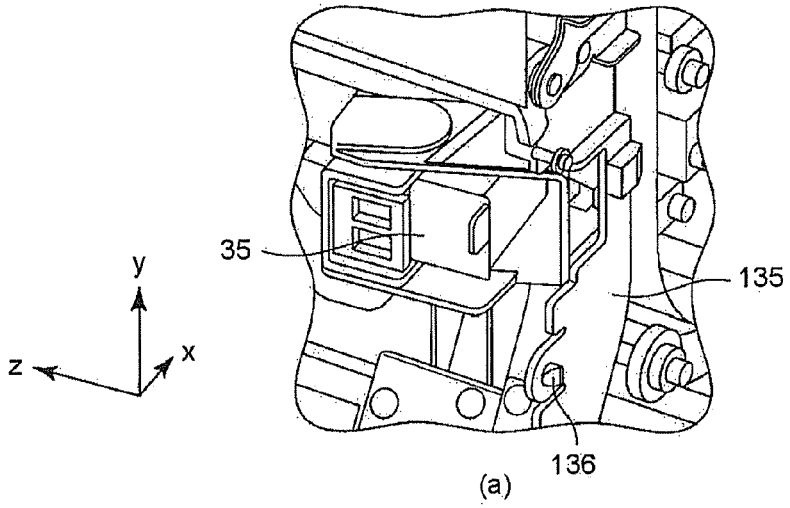
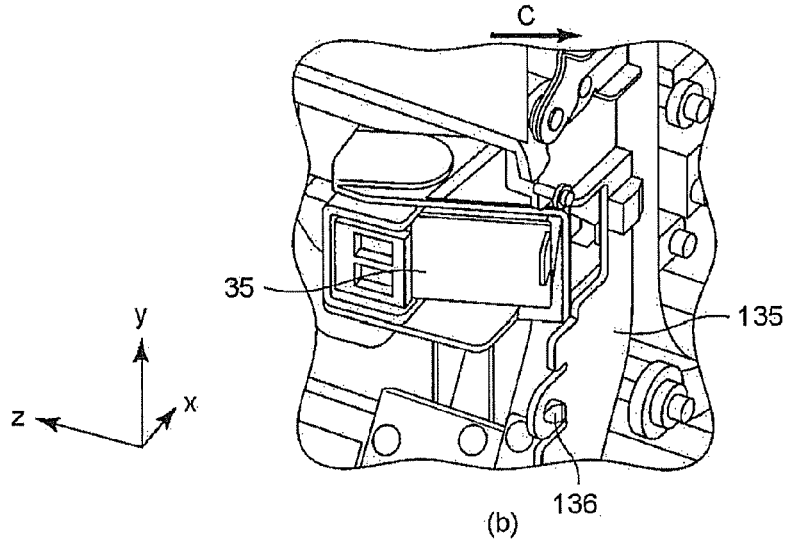
135
y
149a
135a
z
x
(b)

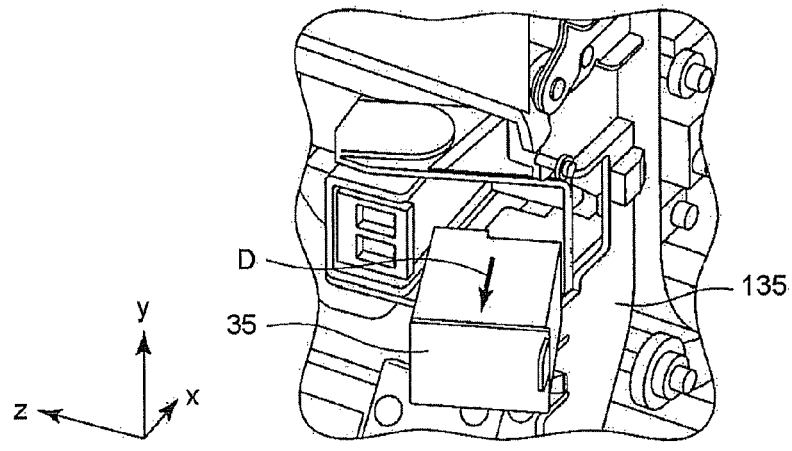
FIG.8



(a)

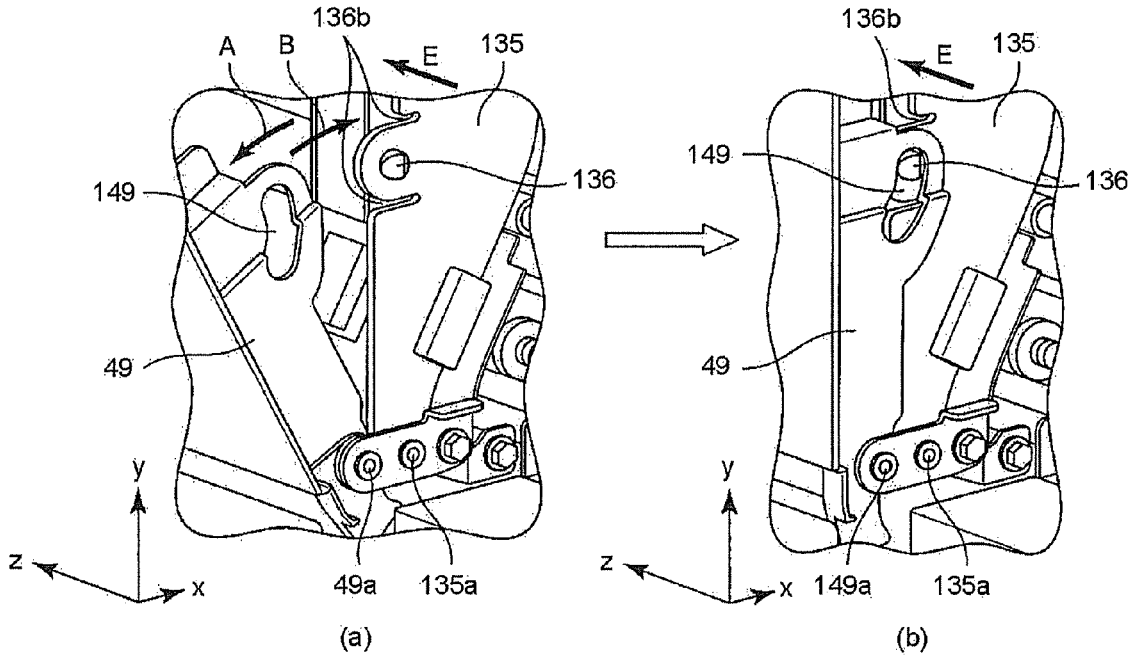


(b)



(c)

FIG.9


136b
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z
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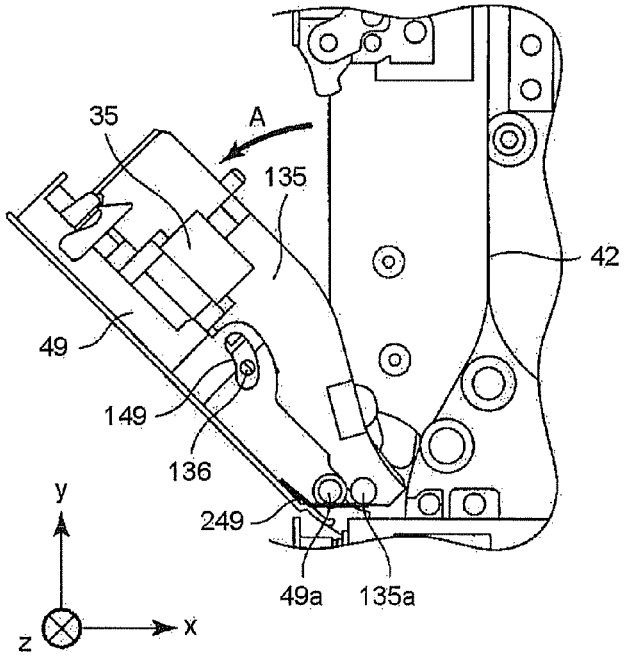
149a
135a
(b)

FIG.10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42
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y
249
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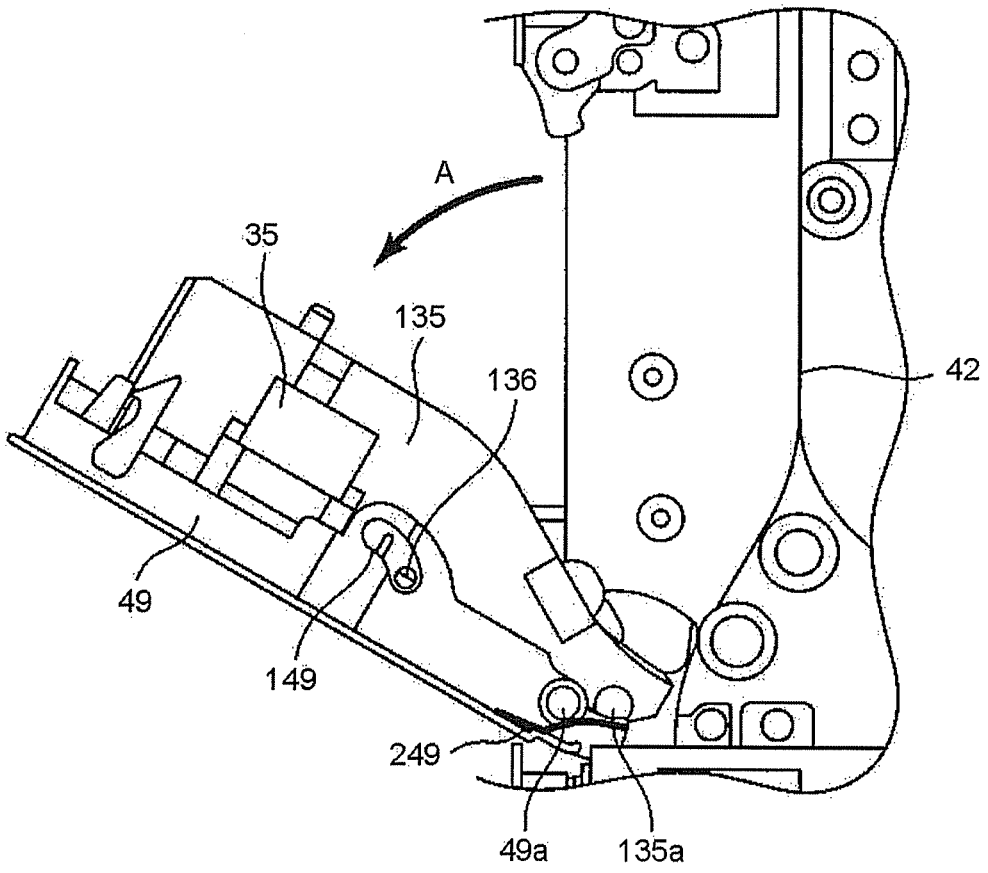
49a
135a

FIG.11



SHEET PROCESSING APPARATUS AND COLOR ERASING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2013-102623, filed May 14, 2013, No. 2014-094254 filed Apr. 30, 2014, the entire contents of which are incorporated herein by reference.

FIELD

Embodiments described herein relate to a sheet processing apparatus for processing a sheet color-erased by a color erasing apparatus which erases the color of an image visualized with a color material generating color using a developing material.

BACKGROUND

There is an erasing apparatus for erasing the color of an image by making the color generated by a color material invisible so as to reuse a sheet.

The color erasing apparatus heats the visualized color material so as to reduce the effect of the color developing material to the color generation compound (dye precursor compound) which generates color under the effect of the color developing agent and release (erase) the color generation state.

In addition, as the sheet is not reused if the reuse times exceeds a given reuse times, a marking device is used to carry out marking indicating the reuse times on the color-erased sheet during the color erasing processing so that a user can know the reuse times. In most cases, the marking device is an optional device (individual addition device).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram illustrating one example of a color erasing apparatus according to one embodiment;

FIG. **2** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **3** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **4** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **5** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **6**A is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **6**B is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **6**C is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **7** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **8** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **9** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment;

FIG. **10** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment; and

FIG. **11** is a diagram illustrating one example of main portions of the color erasing apparatus according to the embodiment.

DETAILED DESCRIPTION

In accordance with one embodiment, a sheet processing apparatus comprises a main body side guiding module, a first movable module, a second movable module and a connection module. The main body side guiding module guides a sheet. The first movable module provides a conveyance path for conveying the sheet between the main body side guiding module and the first movable module at a first position opposite to the main body side guiding module, and moves to a second position to open (expose) the conveyance path through motion from the first position towards a first direction. The second movable module holds a detachable processing module for carrying out a given processing on the sheet, and moves integrally with the first movable module from the first position to the second position. The connection module connects the second movable module with the first movable module in such a manner that the second movable module can move to a third position to expose the processing module through motion from the second position in a second direction opposite to the first direction.

Embodiments are described below with reference to the accompanying drawings.

A color erasing apparatus **101** shown in FIG. **1** includes at least a paper feed section **10**, a color erasing section **21**, a reading section **30**, a conveyance section **40**, a control section **50** and a paper discharge section **60**.

The paper feed section **10** comprises a color-unerased sheet holding section (hereinafter referred to as a paper feed cassette) **11** for receiving (sheet is set) a color-unerased sheet (paper) on which there is an image (color material) to be erased; a conveyance path **41** (conveyance section **40**) for guiding the color-unerased sheet held by the paper feed cassette **11** to the color erasing section **21** which will be described later; and a paper feed roller **12**, a conveyance roller **13** and a conveyance roller **14** for applying, to a color-unerased sheet, propulsion (conveyance force) through which the color-unerased sheet can be conveyed (moved) in the conveyance path **41**.

The conveyance path **41** is connected with a conveyance path **42** (conveyance section **40**) one part of which is shared with the reading section **30** described later.

The conveyance path **42** (conveyance section **40**) conveys the color-unerased sheet which is to be guided to the color erasing section **21**, or guides a sheet (hereinafter referred to as color-erased sheet) the image on which is color-erased (erase the color generated by the color material) in the color erasing section **21** to the color-erased sheet holding section (hereinafter referred to as paper discharge section) **60**. The conveyance path **42** is provided with conveyance rollers **33** and **34** for respectively applying, to the color-unerased sheet and the color-erased sheet, propulsion through which the sheet can be conveyed in the conveyance path **42**.

The color erasing apparatus **101** includes a branching device **22** for distributing color-unerased sheets from the conveyance path **42** towards the color erasing section **21** based on a reading result of the reading section **30** described later; a conveyance path **47** (conveyance section **40**) for guiding the color-unerased sheet distributed by the branching device **22** to the color erasing section **21**; conveyance rollers **23**~**25** for applying, to the color-unerased sheet, propulsion through which the color-unerased sheet can be conveyed to the color erasing section **21**; and conveyance rollers **26**~**28** for guiding the color-erased sheet subjected to the color erasing processing by the color erasing section **21** to the conveyance path **42**. The color erasing section **21** applying a color erasing temperature (heat) above a given temperature to the sheet passing through a nip area between, for example, two rollers which are arranged in such a manner that the axes thereof for defining the center of rotation are actually parallel to each other, or between a roller and an endless belt, so as to reduce the effect of the color developing agent to the color generation compound (dye precursor compound) which generates color under the effect of the color developing agent and release the color generation state, thereby erasing the color. In addition, the color erasing temperature (heat) is provided by, for example, a heater lamp integrated in a roller, or an IH (induction heating) heater which generates induction heat to a metal surface of a roller or a metal layer of a belt.

The reading section **30** comprises a first and a second image sensors **31** and **32** for detecting that the sheet conveyed in the conveyance path **42** is the color-unerased sheet, or detecting the existence of marking (marker) indicating the reuse times in a case where the sheet is a sheet (hereinafter referred to as reuse sheet) which is subjected to the color erasing processing repeatedly.

The first and the second image sensors **31** and **32**, which are, for example, image capturing sensors such as CMOS sensors, detect the shape of a sheet conveyed in the conveyance path **42**, for example, the change in size (area) with respect to the specified unique size of a sheet such as a bending or a rip, the existence of images on both sides of a sheet and the reuse times indicated by a marker.

The color erasing apparatus **101** includes a marking device (individual addition device) **35** for marking (adding a marker) the reuse times on a sheet. The marking device **35** referred to as an imprinter adds (prints) a marker indicating the reuse times to a sheet with, for example, ink which maintains the color generation state even if heat is applied (to the sheet) by the color erasing section **21**.

The image information and the (information of) reuse times indicated by the marker respectively acquired by the image sensors **31** and **32** are converted from the image information to (digital) image data through an A-D (analog-digital) conversion, and then are stored, in an image memory and a NVM (Non Volatile Memory) of a storage device connected with the control section **50**, as the image data and reuse times data at a unit of one sheet or one page (surface).

The conveyance path **42** is connected with a conveyance path **43** which guides the color-erased sheet distributed by the branching device **22** to the paper discharge section **60**.

The conveyance path **43** (conveyance section **40**) including at least a paper discharge branching device **16** and a conveyance roller **15**, guides the color-erased sheet distributed by the branching device **22** to either of a first color-erased sheet holding section (hereinafter referred to as reuse sheet cassette) **61** and a second color-erased sheet holding section (hereinafter referred to as stocker) **62** of the paper discharge section **60**. The color-erased sheet to be stored in the reuse sheet cassette **61** is guided by a conveyance roller **63** and a conveyance path **44** (conveyance section **40**). The color-erased sheet to be stored in the stocker **62** is guided by conveyance rollers **64** and **65** and conveyance paths **45** and **46** (conveyance section **40**, respectively).

A cover **49** of the marking device section is arranged nearby the conveyance path **42** to expose part of the conveyance path **42**, so as to, for example, carry out jam processing for the sheet jam of the sheets moving in the conveyance path **42**, or to refill ink into the marking device **35**. The covers for exposing part of the conveyance path to carry out jam processing for the sheet jam, though not being described in detail, are also arranged nearby the color erasing section **21**, the first and the second image sensors **31** and **32**, and the like.

The control section **50** includes a CPU (Central Processing Unit, control unit) **51**; a color erasing amount determination section, a shape determination section, an input/output (I/O) port, a motor driving section, a conveyance path switching control section and a temperature control section which are all connected with the CPU (control unit) **51**.

A memory (storage device) **52** is also connected with the CPU **51**. The storage device (memory) **52** includes an image memory (page memory), a ROM (Read Only Memory (for program)), a RAM (Random Access Memory, Rewritable memory) and a NVM (nonvolatile memory) and the like.

The control section **50** is further provided with an operation section for receiving an instruction input indicating the ON/OFF of the main power source or the start of a color erasing operation, and the like; and a display section for displaying operations corresponding to the instruction input in the operation section, a specified UI (User Interface) relating to a user processing, for example, the timing for refilling ink to the marking device **35**, sheet jam at any position in the conveyance section **40**, the procedure of the processing in the jam (sheet jam), and the like. Further, a touch panel type in which the operation section and the display section are integrated into one single body is preferred. The marking device **35** may be of such a type that the marking device **35** itself is exchanged to refill ink, instead of exchanging a cartridge, and in this case, the exchanging timing of the marking device **35** is also displayed.

The control unit (CPU) **51** controls the operation of each section according to the operation program stored in the ROM of the storage device **52**.

The ROM stores the operation program for operating the color erasing section **21**, reference values used for the comparison with the detection result of the first and the second image sensors **31** and **32**, and the like.

The RAM receives an input from JAM sensors which are arranged, to detect jam (sheet jam), at specified positions of each conveyance path **41**~**47** (conveyance section **40**) input through the I/O port, and stores, for example, temporary data generated during the execution of the processing routine according to the instruction input (operation information) from the operation section.

The I/O port converts, for example, the instruction input from the operation section so that the content of the instruction input can be processed by the control unit **51**. The I/O port further contributes to receiving control instructions to various components included in the paper discharge section **60** such as motors and branching devices, and receiving detection values detected by any sensor.

The operation section receives, for example, an input of a control instruction from the user, and outputs the control command corresponding to the control instruction so that the control command can be read by the control unit **51**.

The storage device **52** stores the image data before color erasing processing corresponding to the image information

before color erasing processing of the sheet to be color-erased detected by the first and the second image sensors **31** and **32**, and the reuse times indicated by the marker.

The paper discharge section **60** guides the color-erased sheet from the conveyance path **43** to either of the reuse sheet cassette **61** and the stocker **62** through the branching device **16**.

An example is briefly described below in which the color generated by the toner on the sheet having a visible image (toner image) formed with color erasable toner is erased, and the sheet is stored in either of the reuse sheet cassette **61** and the stocker **62**.

The sheet held by the paper feed cassette **11** is moved from the conveyance path **41** to the conveyance path **42**, and if a toner image (image) is detected by either of the first and the second image sensors **31** and **32**, the sheet is further moved to the color erasing section **21** via the conveyance path **47**.

The sheet of which the color generated by the toner is erased by the color erasing section **21** passes through the conveyance paths **42** and **43**, and then is moved to either of the reuse sheet cassette **61** and the stocker **62** via the path provided with the conveyance roller **63** and the branching device **16** which carries out a switching processing according to the setting stored in the rewritable memory (RAM) indicating whether to store the sheet in the reuse sheet cassette **61** or the stocker **62**.

Hereinafter, under the control of the control unit **51**, the image data before color erasing processing stored in the storage device **52** is compared with the image data after color erasing processing read by the first and the second image sensors **31** and **32** of the reading section **30** again after the color erasing processing carried out by the color erasing section **21**, so as to determine the existence of a color erasing residual image.

In a case where the degree of the color erasing residual image (level/image residual amount) is at a level (image residual amount) at which the sheet can be reused, the sheet is moved to the paper discharge section **60** after being added (printed), by the marking device **35**, with a marker obtained by adding "1" to the reuse times read from a former marker before the (former) conveyance to the color erasing section **21**. In a case where the image residual amount of the color erasing residual image exceeds the level (residual amount) at which the sheet can be reused, the sheet is conveyed to the color erasing section **21** again. In addition, if it is determined that the sheet is reused for so many times that the sheet cannot be reused again, the sheet is conveyed to the stocker **62** in the paper discharge section **60** after the storage (for example, discard flag setting on data) based on the RAM, even if the residual amount of the color erasing residual image is at a level (image residual amount) at which the sheet can be reused.

Further, in the color erasing apparatus shown in FIG. **1**, it is possible that, for example, the reading section **30** is omitted, and the color of the color material of the toner from the toner images on all the sheets passing through the color erasing section **21** is erased.

Next, the opening/closing of the cover **49** for removing the sheets jammed in the marking device and the head exchange of the marking device are described with reference to FIG. **2**(*a*) and FIG. **2**(*b*)~FIG. **8**(*a*) and FIG. **8**(*b*).

The cover **49** can be positioned at a normal position shown by FIG. **2**(*a*) and FIG. **2**(*b*), that is, a first position where the sheet can be conveyed for the image color erasing operation; a jam processing position shown by FIG. **3**(*a*) and FIG. **3**(*b*), that is, a third position where the conveyance path is exposed for the sheet jam processing; or an exchange position shown by FIG. **4**(*a*) and FIG. **4**(*b*) for exchanging the (head part of) marking device, that is, a second position where the marking device **35** can be detached or attached. In addition, the directions indicated by an arrow A and an arrow B in each drawing are two opposite directions in the x-y plane. Further, for the sake of convenience of description, though FIG. **4**(*a*) and FIG. **4**(*b*) are referred to as the exchange position for exchanging the (head part of) marking device, the jam processing can also be carried out at the position shown by FIG. **4**(*a*) and FIG. **4**(*b*).

The first position shown in FIG. **2**(*a*) shows a state in which the cover **49** is closed (not-opened), and a printer guide **135** for supporting the marking device **35** (head) maintains a (engaging) state in which a pin part **136** positioned at a given position of the same guide **135** is integrated, in an interlocking manner, with a cover side irregular hole (cam hole) **149** (of the cover **49**). As shown in FIG. **2**(*b*) which is an oblique view viewed in a state where a certain angle is given so that the position relation (engaging state) between the cover side irregular hole **149** and the pin part **136** is clear enough in the x-y plane, the pin part **136** is integrally held within an operation range specified by the cam hole **149** with respect to the opening (closing) operation of the cover **49**. The printer guide **135** rotates around a rotation fulcrum **135***a*, and the cover **49** rotates around a rotation fulcrum **49***a*. That is, the rotation fulcrum of the printer guide **135** is different from that of the cover **49**. The position relation between the pin part **136** and the irregular hole **149** is described in detail later with reference to FIG. **6**A~FIG. **6**C.

FIG. **4**(*a*) and FIG. **4**(*b*) shows the second position (position where the opening angle is the largest), that is, a state in which the cover **49** is opened (pulled down towards the left side in the state shown in FIG. **1**) in the direction indicated by the arrow A to a given position for the jam processing, via the middle position shown in FIG. **3**(*a*) and FIG. **3**(*b*) where the connection between the irregular hole **149** and the pin part **136** is not released. In FIG. **4**(*a*) and FIG. **4**(*b*), the printer guide **135** is synchronously opened (maintaining the integrated state) in the (engaging) state in which the pin part **136** is integrated with the cover side irregular hole (cam hole) **149** (of the cover **49**). As shown in FIG. **4**(*b*) which is an oblique view viewed in a state where a certain angle is given, the cover side irregular hole **149** positions the pin part **136** within the operation range specified by the cam hole **149** with respect to the opening operation of the cover **49** at the second position in the x-y plane. That is, the opening amount (opening angle) of the cover **49** is within a given area (operation range), and the pin part **136** of the guide **135** is integrally moved (opened) with the cover **49** by interlocking with the opening operation of the cover **49**.

FIG. **5**(*a*) and FIG. **5**(*b*) shows a state in which the printer guide **135** is returned from the second position shown in FIG. **4**(*a*) and FIG. **4**(*b*) to a given position (for example, the third position where the printer guide **135** is positioned in FIG. **3**(*a*)) in the direction indicated by the arrow B opposite to the direction indicated by the arrow A in the x-y plane. As shown in FIG. **4**(*b*), if the cover **49** and the printer guide **135** are positioned at the second position, the pin part **136** can be separated from the irregular hole **149**. Thus, in the state in which the cover **49** is positioned at the second position, the printer guide **135** can be moved into the state shown in FIG. **5**(*a*).

That is, the printer guide **135** positioned at the second position shown in FIG. **4**(*a*) is in a state in which it can be moved in the direction indicated by the arrow B shown in FIG. **5**(*a*). In other words, in a state of maintaining the cover **49** at the second position shown in FIG. **4**(*a*) and FIG. **4**(*b*), the

printer guide **135** can be separated from the cover **49** and moved in the direction indicated by the arrow B.

Though the printer guide **135** is synchronously opened (maintaining the integrated state) in the (engaging) state in which the pin part **136** is integrated with the cover side irregular hole **149**, the pin part **136**, as shown in FIG. **5**(*b*) which is an oblique view viewed in a state where a certain angle is given in the x-y plane, is positioned within the operation range practically specified from the regulation (position) based on the cam hole **149** of the cover **49**. That is, the guide **135** (pin part **136**) is integrally moved (opened) with the cover **49** by interlocking with the opening operation of the cover **49** until the position shown in FIG. **4**(*a*). The guide **135**, if positioned at the second position, is released from the regulation based on the cam hole **149** of the cover **49**, thus, the guide **135** can be moved towards the direction indicated by the arrow B opposite to the direction indicated by the arrow A.

That is, in the operation period (normal position), in the state viewed from the x-y plane shown in FIG. **6**A(*a*) and in the state viewed from a y-z plane (right side of the state viewed from the x-y plane) orthogonal to the x-y plane shown in FIG. **6**A(*b*), the guide **135** holding the marking device **35** is integrated with the cover **49** due to the engaging between the irregular hole **149** of the cover **49** and the pin part **136**, and therefore the guide **135** cannot be separated from the cover **49**; as shown in FIG. **6**B(*a*) and FIG. **6**B(*b*), in the state viewed from the y-z plane, as the engaging between the irregular hole **149** and the pin part **136** is still maintained even in the state in which the cover **49** is opened to the middle position, therefore the guide **135** cannot be separated from the cover **49**. As shown in FIG. **6**C(*a*) and FIG. **6**C(*b*), in the state in which the cover **49** is opened completely in the direction indicated by the arrow A, the guide **135** positioned at the rear side of the cover **49** can be opened in the direction indicated by the arrow B. That is, by positioning the cover **49** and the guide **135** at the second position, as shown in FIG. **6**C(*a*) and FIG. **6**C(*b*), the connection sections (that is, the irregular hole **149** of the cover **49** and the pin part **136**) are at a position (the position where the pin part **136** comes off easily) where the irregular hole **149** and the pin part **136** are disconnected in the transverse direction.

Thus, as shown in FIG. **4**(*a*), in the state in which the pin part **136** is practically released from the irregular hole **149**, the printer guide **135** is in a state of covering on the cover **49** due to the weight thereof; as shown in FIG. **5**(*a*), if a user moves the printer guide **135** in the direction indicated by the arrow B, a space can be formed in which the marking device **35** can be detached or attached. Further, with such a constitution described above, during the jam process (for example, FIG. **3**(*a*)), it is possible not to expose the internal space in which the marking device **35** can be detached or attached. In addition, by optimizing the height of the pin part **136** (the protrusion amount of the pin part **136** towards the irregular hole **149**) or the shape of the pin part **136**, or both the height and the shape, in a case of desiring to merely open the cover **49** for the jam processing, the printer guide **135** can be released from the connection (integration) with the cover **49**, and the space therebetween can be exposed.

In this way, in the embodiment, a conveyance guide section (marking device **35**) and a cover section (cover **49**) are respectively rotate (opened/closed) around separate rotation fulcrums, and a connection module for connecting the conveyance guide section and the cover section is provided; in the open area in the openable/closable range, the conveyance guide section and the cover section are connected with each other in an area of more than approximate half, and a state in which the connection is released or is easily to be released for positioning the printer guide **135** to the third position in a state in which the cover **49** is positioned at the second position is provided. Further, the connection module includes the pin part and the irregular hole, and as the phase deviates at a position where the cover section and the guide section are opened, a connection state can be provided in which the pin part is inserted into the irregular hole at a cover closed position and easily comes off from the irregular hole at a cover opened position.

In addition, the irregular hole **149** of the connection module may be positioned at the printer guide **135**, and the pin part **136** may be positioned at the cover **49**. Further, in a case where there is a plurality of connection modules, the combination between the pin part and the irregular hole for each connection module may be different.

FIG. **7**(*a*) and FIG. **7**(*b*) shows a state in which the printer guide **135** is erected at the side of the conveyance path **42** by further moving the guide **135** in the direction indicated by the arrow B from the state shown in FIG. **5**(*a*) and FIG. **5**(*b*) so as to, for example, exchange the marking device (individual addition device). That is, FIG. **7**(*a*) and FIG. **7**(*b*) shows a state in which the space for exchanging the marking device **35** is exposed so that the marking device **35** can be detached and attached in the space between the cover **49** and the guide **135**.

The printer guide **135** is moved in the direction indicated by the arrow B, thereby erecting (stabilizing) the printer guide **135** and the marking device **35** at the position shown in FIG. **7**(*a*).

The marking device **35** can be detached according to the marking device exchanging procedure shown in FIG. **8**(*a*)~FIG. **8**(*c*). That is, by moving (pulling the marking device towards the direction indicated by an arrow C) the marking device **35** at the operation position (FIG. **8**(*a*)) towards an unlocking position (moving the marking device **35** towards the direction indicated by the arrow C) shown in FIG. **8**(*b*), the marking device **35** can be moved to a head removing position indicated by an arrow D shown in FIG. **8**(*c*). In addition, an opposite procedure is carried out to install the marking device **35**.

That is, by applying the embodiment, there is no need to arrange a dedicated opening portion and a lock mechanism or a lever and the like for the individual addition device needing user processing, which prevents the increase in the apparatus cost. In addition, the workability (convenience) of the user processing carried out for a user processing device such as the individual addition device can be improved as well.

FIG. **9**(*a*) and FIG. **9**(*b*) show features of the shape of the pin part of the printer guide.

As shown in FIG. **9**(*a*), the pin part **136** of the printer guide **135** includes, for example, a chamfered (C cut) inclined portion **136***a*. With the inclined portion **136***a*, the cover **49** moving in the direction indicated by the arrow B can returns to the engaging (connection position) with the pin part **136** easily, and through the motion in the direction indicated by the arrow B, the peripheral area of the irregular hole **149** gets over the pin part **136**, and the force required to position the pin part **136** in the irregular hole **149** can be reduced.

That is, by arranging the inclined portion (an area that can reduce the resistance to the moving cover **49**) **136***a* on the pin part **136**, the peripheral area of the irregular hole **149** of the cover **49** moving in the direction indicated by the arrow B can get over the pin part **136** easily from the side of the inclined portion **136***a*.

In addition, slits **136***b* are arranged at given positions of a printer guide **135** where the pin part **136** is positioned, for example, positions equidistant from the center of the pin part **136**, thereby achieving elastic deformation towards the direc-

tion indicated by an arrow E (y-z plane, that is, the direction generally orthogonal to the moving direction of the cover); thereby reducing the resistance to the peripheral area of the irregular hole **149** of the cover **49** when the peripheral area of the irregular hole **149** of the cover **49** moving in the direction indicated by the arrow B gets over the pin part **136** from the side of the inclined portion **136***a*.

In this way, in a case of returning the cover **49** to the original position when the exchange of the marking device **35** is completed, the cover **49** can be returned to the normal position (first position) shown in FIG. **2**(*a*) only by moving the cover **49** in the direction indicated by the arrow B as it is, even in a state in which the printer guide **135** is erected as shown in FIG. **7**(*a*).

FIG. **10** and FIG. **11** are diagrams illustrating one example of features of the effective structure in a state in which the printer guide is integrated with the cover.

The second position described in FIG. **4**(*a*) is a position where the cover **49** bears all the weight of the printer guide **135**. Thus, for example, by arranging a stopper member **249** including an elastic body in the shape of a flat spring, it can be prevented that the cover **49** is opened to the largest opening position in the direction indicated by the arrow A in one operation due to the total weight of the cover and the printer guide. That is, in a case of desiring to merely open the cover **49** for the jam processing, it can be prevented that the printer guide **135** is opened and released from the connection with the cover **49** in one operation due to the total weight of the cover and the printer guide, and the space between the marking device **35** and the cover **49** is exposed undesirably (refer to FIG. **10**).

In addition, in a case where the stopper member **249** is an elastic body in the shape of a flat spring, the cost for fixing the stopper member can be reduced by, for example, sharing the rotation fulcrum **49***a*.

Further, by making the stopper member **249** an elastic body in the shape of a flat spring, in a case of opening the cover **49** to the largest opening position, the cover **49** can be opened to the largest opening position shown in FIG. **11** (FIG. **4**(*a*)) only by further applying a force in the direction indicated by the arrow A to the cover **49** from the third position shown in FIG. **10** (FIG. **3**(*a*)).

That is, by using the stopper member **249**, in a general cover opening (jam processing) operation, a temporary opening stop force is applied (the state shown in FIG. **3**(*a*)) at a position where the marking device **35** between the printer guide **135** and the cover **49** is not opened to the exposed position, and a position (FIG. **4**(*a*)) where the guide **135** can be released from the connection with the cover **49** can be provided by further applying an opening force (moving the cover **49** in the direction indicated by the arrow A).

In this way, by arranging an inclined portion which can reduce the resistance to the irregular hole moving towards the pin part of the connection module, the workability (usability) when exchanging an optional part (individual addition device) needing a user processing can be improved. In addition, by making the member supporting the pin part in the connection module elastically deformable in the direction generally orthogonal to the moving direction of the cover, the workability of the user processing can be further improved.

That is, by applying either or both of the components shown in FIG. **9**(*a*) and FIG. **9**(*b*) and the component shown in FIG. **10**, the workability of the user processing can be improved, and when the user processing is completed, the cover and the like can be easily and correctly returned to the operation position, and the operation failure caused by, for example, that the user forgets to return the cove by some chance (or the cover is moved to an incomplete position different from the normal position) can be prevented.

In accordance with the embodiment described above, in the color erasing apparatus for erasing the color of the image visualized with an image developing material, that is, a color material and the sheet processing apparatus for processing the sheet the color of which is erased by the color erasing apparatus, it is possible to reduce the cost of the apparatus and meanwhile to facilitate the user processing carried out for the user processing device needing the user processing.

Further, the workability of the user processing can be improved, and the operation failure caused by, for example, that the cover is moved to an incomplete position different from the normal position when the user processing is completed can be prevented.

The "color erasing processing", though exemplified as erasing the color of the image in the embodiment described above, may also include a meaning of erasing the image. That is, the color erasing apparatus described herein is not limited to an apparatus for erasing the color of the image by heating. For example, an apparatus which erases the color of the image on a sheet by radiating light or an apparatus which erases the color of the image formed on a special sheet may also be applied. Alternatively, the color erasing apparatus may be an apparatus for removing (erasing) the image on a sheet. No specific limitation is given to the color erasing apparatus as long as the color erasing apparatus can make the image on a sheet invisible so as to reuse the sheet.

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the invention. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

What is claimed is:

1. A sheet processing apparatus, comprising:

a main body side guiding module configured to guide a sheet;

a first movable module configured to provide a conveyance path for conveying the sheet between the main body side guiding module and the first movable module at a first position opposite to the main body side guiding module, and move to a second position to open the conveyance path through motion from the first position towards a first direction;

a second movable module configured to hold a detachable processing module for carrying out adding a mark on the sheet to indicate the reuse times of the sheet, and move integrally with the first movable module from the first position to the second position; and

a connection module comprising a rotation fulcrum, wherein the rotation fulcrum couples the second movable module with the first movable module in such a manner that the second movable module can move to a third position to expose the processing module through rotational motion from the second position in a second direction opposite to the first direction.

2. The sheet processing apparatus according to claim **1**, wherein

the connection module releases, when the second movable module moves in the second direction, the connection between the first movable module and the second mov-

able module so that the second movable module can be moved to the third position.

3. The sheet processing apparatus according to claim **2**, wherein

the connection module includes a fitting structure which releases the connection between the first movable module and the second movable module at the second position, and only the second movable module can be moved from the second position to the third position.

4. The sheet processing apparatus according to claim **1**, wherein

the connection module includes an elastic structure for restoring the connection between the first movable module and the second movable module when the first movable module moves in the second direction.

5. A color erasing apparatus, comprising:

a color erasing module configured to eliminate the color generation of a color material constituting an image to erase the color;

a main body side guiding module configured to guide a sheet to the color erasing module;

a first movable module configured to provide a conveyance path for conveying the sheet between the main body side guiding module and the first movable module at a first position opposite to the main body side guiding module, and move to a second position to open the conveyance path through motion from the first position towards a first direction;

a second movable module configured to hold a detachable processing module for carrying out adding a mark on the sheet to indicate the reuse times of the sheet, and move integrally with the first movable module from the first position to the second position; and

a connection module comprising a rotation fulcrum, wherein the rotation fulcrum couples the second movable module with the first movable module in such a manner that the second movable module can move to a third position to expose the processing module through rotational motion from the second position in a second direction opposite to the first direction.

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